

considerably reduced when at least $\text{SmAl}_{11}\text{O}_{18}$ phase is formed in the sintered body.

The inventors have further studied the microstructure of an aluminum nitride sintered body with the reduced volume resistivity using various kinds of apparatuses described below, and found the following characteristic microstructure. Such sintered body has network microstructure made of samarium-aluminum complex oxide phase. The oxide phase is continuously formed and surrounds aluminum nitride grains in the body. It is considered that such network microstructure may contribute to the reduction of the volume resistivity.

According to the Japanese patent publication (Kokoku) with a publication number 46032/1988, 3 weight percent of samarium oxide (converted content calculated as samarium) is added to raw powder of aluminum nitride to provide mixed powder, which is then hot pressed to obtain an aluminum nitride sintered body. The publication, however, does not teach the change of the volume resistivity of the sintered body. Moreover, the publication does not teach the relationship between the precipitation of $\text{SmAl}_{11}\text{O}_{18}$ phase and the volume resistivity, as well as the network microstructure formed in the sintered body. It is considered that the discovery of the relationship and microstructure was beyond the state of art at that time.

Brief Description of the Drawings

Fig. 1 is a graph showing the temperature dependency of volume resistivity of each of the sintered bodies according to examples 1, 2 and comparative examples 6, 7 and 8.

Fig. 2 is an X-ray diffraction profile of the sintered body according to the example 1.

Fig. 3 is a phase diagram of alumina-samarium oxide system.

Fig. 4 shows the results of EPMA analysis of elements in the sintered body according to the example 1.

Fig. 5 shows the results of EPMA analysis of elements in the sintered body according to the comparative example 3.

Fig. 6 shows the result of EPMA analysis of samarium in the sintered body according to the example 1.

Fig. 7 shows the result of EPMA analysis of samarium in the sintered body according to the comparative example 3.

Fig. 8 is a photograph taken by an atomic force microscope showing the current distribution analysis image of the sintered body according to the example 7.

Fig. 9 is a photograph taken by an atomic force microscope showing the current distribution analysis image of the sintered body according to the example 7.

Fig. 10 is a photograph showing a backscattering electron image taken by a scanning electron microscope over the same visual field as Fig. 9.

Fig. 11 is a graph showing the temperature dependency of volume resistivity of each of the sintered bodies according to examples 22 and 30 and comparative examples 9 and 10.

Fig. 12 is an X-ray diffraction profile of the sintered bodies according to the examples 24 and 25 and comparative examples 9 and 10.

Fig. 13 shows a backscattering electron image of a polished surface of the sintered body according to the example 24.

Fig. 14 shows a backscattering electron image of a polished surface of the sintered body according to the example 25.

Fig. 15 shows a backscattering electron image of a polished surface of the sintered body according to the comparative example 9.

Fig. 16 shows a backscattering electron image of a polished surface of the sintered body according to the comparative example 10.

Preferred embodiments of the Invention

The converted content of samarium calculated as the oxide may preferably be not lower than 0.05 mole percent for obtaining the effects of the invention.

However, when the content of samarium is too large, the thermal conductivity of the inventive aluminum nitride sintered body tends to be lower. The converted content of samarium calculated as the oxide may preferably be not higher than 10 mole percent, and most preferably be not higher than 5 mole percent, for preventing the reduction of the thermal conductivity.

The aluminum nitride sintered body and material according to the invention may have a relatively low change of the volume resistivity in a higher temperature range, for example temperature range not higher than 300 °C.